**Chlamydia trachomatis infection in rural Nova Scotia**

Donald B. Langille, MD, MHSc; Jeannie Shoveller, MA

**Objective:** To examine the demographic characteristics of patients who underwent testing for *Chlamydia trachomatis* and to determine the clinical and behavioural characteristics and the types of treatment for those who had positive test results.

**Design:** Case series.

**Setting:** Rural county in Nova Scotia.

**Patients:** All residents of the county for whom testing for *C. trachomatis* was ordered at the regional hospital from Sept. 1, 1990, to Mar. 31, 1991.

**Main outcome measures:** Rates of testing and of positive test results by age and sex. Comparison of patient and physician characteristics in relation to testing rates.

**Results:** Of the 1116 patients tested 58 (5.2%) had positive test results. Females accounted for 82.8% of those with positive results whose sex could be determined. Among the females the mean age of those with a positive result was 22.3 years, as compared with 27.5 years for those with a negative result (*p* < 0.0001). Females 15 to 19 years of age were less likely to have a test performed than women 20 to 29 years and were more likely to have a positive test result than the women in the older groups. Almost 9% of the testing among the females was in those over 39 years of age, although no infection was seen in this age group. The number of tests ordered per general or family practitioner varied from 1 to 154; the physicians’ sex, practice location and length of time in practice did not predict the rates of positive test results. Treatment was most often in keeping with that recommended by national guidelines. Four (8.5%) of the 47 patients with positive results who were interviewed were not aware of their diagnosis, either because they had not returned for follow-up or had not being notified by the physician’s office.

**Conclusions:** The frequency of testing for *C. trachomatis* infection may be less than is desirable among young patients, who, if tested, are more likely than older patients to have positive results. More understanding of the diagnostic approach taken by physicians is needed.

**Objectif** : Analyser les caractéristiques démographiques des patients qui ont subi un test de dépistage du *Chlamydia trachomatis* et déterminer les caractéristiques cliniques et comportementales des sujets dont les résultats ont été positifs, ainsi que le genre de traitement qu’ils ont reçu.

**Conception** : Série de cas.

**Contexte** : Comté rural de la Nouvelle-Écosse.

**Patients** : Tous les résidents du comté pour lesquels on a prescrit un test de dépistage du *C. trachomatis*, à l’hôpital régional, entre le 1er septembre 1990 et le 31 mars 1991.

**Mesures des résultats principaux** : Taux des tests et des résultats positifs selon l’âge et le sexe. Comparaison des caractéristiques des patients et des médecins par rapport aux taux des tests.

**Résultats** : Des 1 116 patients qui ont subi un test, 58 (5,2%) ont eu des résultats positifs. On a compté 82,8% de femmes chez les sujets dont les résultats ont été positifs et dont le sexe pouvait être déterminé. Les femmes dont les résultats ont été positifs étaient âgées en moyenne de 22,3 ans, et celles dont les résultats ont été négatifs, de 27,5 ans (*p* < 0.0001). Les femmes âgées de 15 à 19 ans étaient moins susceptibles de subir un test que celles de 20 à 29 ans. Leurs résultats étaient plus susceptibles d’être positifs que ceux des femmes des...
Infection caused by *Chlamydia trachomatis* is the most commonly reported sexually transmitted disease (STD) in Canada. More than 50,000 cases were reported in 1989–90, three times as many having occurred in women as in men. In Nova Scotia the number of reported cases has been relatively stable since 1987, with 2230 in 1991. More than 70% of reported cases in this province occur in people less than 25 years old.

Female genital infection due to *C. trachomatis* contributes substantially to the occurrence of pelvic inflammatory disease, infertility and ectopic pregnancy.** High rates of infection are noted among contacts, many of whom are asymptomatic.** Up to 70% of infants have been observed to be at risk for infection if their mothers had chlamydial cervicitis and gave birth vaginally. Of those infants so infected conjunctivitis will develop in 25% to 50% and pneumonia in 10% to 20%.

Selective screening for genital infection due to *C. trachomatis* has been recommended for women with predisposing demographic, behavioural or clinical characteristics, including age less than 24 years, recent change in sexual partner, presence of mucopurulent cervicitis and use of a nonbarrier method of contraception.

Selective screening has been advocated for women 25 to 34 years of age if the prevalence rate exceeds 5% and for all sexually active adolescents.

We describe a case series in a geographically defined area to determine which age and sex groups are being tested for *C. trachomatis*, the clinical and behavioural characteristics of those infected, the characteristics of physicians ordering the tests and the treatments used in comparison with those recommended in national guidelines.

**Methods**

As part of a study of contact tracing and patient education in cases of genital *C. trachomatis* infection in a rural Nova Scotia county laboratory requisitions for enzyme immunoassay (EIA) to diagnose chlamydial infection from Sept. 1, 1990, to Mar. 31, 1991, performed at the regional hospital serving the county were examined. The Kallestad pathfinder EIA tube test (Sanofi Pasteur Diagnostics, Ville Saint-Laurent, Que.) was used, positive test results being confirmed by means of the blocking antibody assay (sensitivity 84%, specificity 98%).

Patient age, sex, test result and physician name were recorded, if available, from the test requisitions. Patients with positive test results reported to the health unit were followed up by telephone by the medical health officer and asked to participate in a study of physician management of STD cases. They were informed that they had the right to refuse the interview and that such refusal would have no impact on their health care. Those who agreed to participate were interviewed with the use of a standardized questionnaire that had been reviewed for validity by national and regional experts in STD control. Patients who preferred to be interviewed in person were so obliged, the same questionnaire being used.

In addition to questions about the contact-tracing and educational aspects of the study, patients were asked about clinical symptoms, numbers of sexual partners and the type of treatment provided. If patients were unable to name the treatment permission was sought to obtain that information from the pharmacy records.

Physician characteristics were determined using the 1991 Medical Register (Nova Scotia Provincial Medical Board, Halifax). A 1-year internship was assumed to determine the number of years in practice. Physician characteristics were considered to determine whether any differences in sex, practice location or length of time in practice were associated with the likelihood of positive results.

Tests of significance for means were carried out with the use of Student's *t*-test for normally distributed data and the Kruskal–Wallis test for two groups for abnormally distributed data. Proportions were analysed with the χ² test, Fisher's exact test being used if expected values were less than 5.

**Results**

**Patient characteristics**

Of 1116 patients (of whom 989 were known to be female and 83 male) tested for genital infection due to *C. trachomatis* 58 (5.2%) were found to have positive re-
results; this reflects an annual rate of 213 per 100 000 population, a rate comparable to the provincial average of 219 per 100 000 in 1990. Age could be determined from the test requisition for 653 (58.5%) of the 1116 patients (622 females and 31 males). Sex was established for all patients with positive results but could not be established from the requisitions for 44 of those with negative results. Of the females 48 had positive test results, which represented 4.9% of all females tested and 82.8% of all subjects with positive results. Of the males 10 had positive results, which represented 12.0% of all males tested and 17.2% of all subjects with positive results. Of these 58 patients 49 (84.5%) were reached by phone, and 47 (38 females and 9 males) (81.0%) agreed to be interviewed. Age was determined from the test requisition or during the interview for 45 (93.8%) of the females and for all 9 males.

The mean age of the females with positive results was 22.3 (standard deviation [SD] 5.3) years, as compared with 27.6 (SD 8.9) years for those with negative results ($p < 0.0001$). Of the 622 women tested for whom age could be determined 103 were 15 to 19 years old, for a testing rate of 5.4% among the 1906 females in that age group in our county. This rate was significantly lower than the rate in the populations aged 20 to 24 years (9.9%) ($p < 0.0001$) and 25 to 29 years (8.2%) ($p < 0.01$).

Table 1 indicates the rates of positive test results among the females by 5-year age group; the rate in the group aged 15 to 19 years was compared with that in each of the other groups. Of the 103 females aged 15 to 19 years (16.5%) had a positive result; this rate was significantly higher than that in all the other age groups. Only 4 (8.9%) of the 45 females with positive results for whom age was known were over 29; however, 29.8% of all the tests occurred in this age group. Of those over 39 no positive results were recorded, but 55 tests were ordered, representing 4.9% of all tests performed. All 11 female patients younger than 20 years who were interviewed were symptomatic, as compared with 14 of the 27 older patients ($p < 0.01$).

Among the males no similar differences between the age distribution of those with positive results and the age distribution of all males tested were identified. No tests were requested for men above 40 years of age, the highest age at which chlamydial infection was detected in this sex group. The males were significantly more likely than the females to have a positive result (12.0% v. 4.9%, $p < 0.02$).

Table 2 indicates the mean number of sexual partners in the 12 months preceding diagnosis, by age group. The mean number decreased with increasing age among the females, although no significant differences were detected between the age groups. The mean number for females aged less than 25 years was 2.2 (SD 1.1), somewhat different from the mean number for those 25 or older (1.5 [SD 0.7]; $p = 0.055$). Among the males the mean number of partners increased with age up to 29 years; however, these differences in this small group were not significant. The males had more sexual partners on average than the females in the year preceding diagnosis (2.6 v. 2.0); the difference was not significant.

**Physician characteristics**

Tests for *C. trachomatis* were ordered by 48 physicians. The number of tests per physician varied from 1 to 224. When analysis was limited to the 42 general and family practitioners (30 men, 12 women) the number varied from 1 to 154 per physician. Twenty-six of these practitioners were located in the county seat and 16 in the smaller, more rural communities of the county. Fifty percent of the physicians had begun practice after 1979, and the mean number of years in practice was 13.6 (SD 12.2) years. The rates of positive test results did not differ significantly when sex, practice location or graduation after 1983 (the year testing for *C. trachomatis* was introduced in Nova Scotia) were considered. The mean number of tests ordered per physician was significantly higher among those practising in the county seat (26.7 [SD 30.8]) than among those in the smaller communities (8.9 [SD 8.2]) ($p < 0.01$).

**Treatment**

Table 3 indicates the types of treatment prescribed
for the 47 patients interviewed. The length of treatment varied from 7 to 14 days (mean 9.7 [SD 1.1] days). Doxycycline was the most commonly prescribed antimicrobial. Of the eight cases in which erythromycin was prescribed, a dosage of 250 mg four times daily was used in six, the mean length of treatment being 8.8 (SD 1.5) days. The type of treatment could not be established for three patients. Four patients had received no treatment at least 2 weeks after the positive test result had been reported to the health unit. Three of these patients had not been informed of the diagnosis because they had not returned for follow-up or had not been contacted by the physician's office; the fourth had not been informed because a locum physician had performed the test and had left the practice before dealing with the problem.

Discussion

The overall positivity rate among patients tested for C. trachomatis (including those of unknown age and sex) was 5.2%. With this as an estimate of the rate of prevalence of infection in the population, which is probably an overestimation because of testing bias, even tests of very high sensitivity and specificity, such as that used in our study, may yield low predictive values. Testing a population with a prevalence rate of 5% would, with the tests we used, result in a positive predictive value of about 70%, which is not ideal. Physicians should interpret test results with extreme caution in these circumstances. Results of a recent study that examined the practices of primary care physicians in British Columbia indicated that the possibility of a false-positive result is rarely considered.14

Far fewer males than females in our study were tested for chlamydial infection (7.7% v. 92.3%); males accounted for only 17.2% of the cases detected. Since males are as likely as females to be asymptomatic carriers of C. trachomatis,7 infected males either are not being identified and treated or are being treated epidemiologically through contact tracing or on the basis of symptoms, without a diagnostic test being performed. There is evidence that contact tracing is inadequate in this population,19 and this may account for some of the decreased detection in males. Accuracy of diagnosis is important in the management of chlamydial infection. Treatment of presumed gonococcal infection alone may not be adequate for eradicating coexisting chlamydial infection12 and would be more likely to occur when appropriate diagnostic tests are not performed. Also, it is less likely that adequate contact tracing will take place in the absence of an accurate diagnosis.

Very few of the women aged more than 29 years had positive test results, yet 29.8% of the tests were requested for women in that age group. The risk of C. trachomatis infection decreases markedly with age in females, and there is evidence to support a physiologic basis for this.13 Physicians should strongly consider the clinical indications before requesting a test for C. trachomatis in older groups.

Significantly fewer tests were ordered for the fe-

Table 2: Number of sexual partners in the year preceding diagnosis of chlamydial infection, by age group

<table>
<thead>
<tr>
<th>Age group, yr</th>
<th>Mean no. of partners (and SD*)</th>
<th>Range</th>
<th>No. of patients</th>
<th>Mean no. of partners (and SD)</th>
<th>Range</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–19</td>
<td>2.4 (1.4)</td>
<td>1–5</td>
<td>11</td>
<td>2.3 (1.2)</td>
<td>1–3</td>
<td>3</td>
</tr>
<tr>
<td>20–24</td>
<td>2.0 (0.8)</td>
<td>1–3</td>
<td>15</td>
<td>2.5 (0.7)</td>
<td>2–3</td>
<td>2</td>
</tr>
<tr>
<td>25–29</td>
<td>1.7 (0.7)</td>
<td>1–3</td>
<td>9</td>
<td>5.0 (0.0)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>≥ 30</td>
<td>1.0 (0.0)</td>
<td>1</td>
<td>3</td>
<td>2.0 (1.0)</td>
<td>1–3</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>2.0 (1.0)</td>
<td>–</td>
<td>38</td>
<td>2.6 (1.2)</td>
<td>–</td>
<td>9</td>
</tr>
</tbody>
</table>

*SD = standard deviation.

Table 3: Treatment of C. trachomatis infection

<table>
<thead>
<tr>
<th>Drug</th>
<th>No. of patients</th>
<th>Length of treatment, d</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (and SD)</td>
<td>Range</td>
</tr>
<tr>
<td>Doxycycline, 100 mg</td>
<td>26</td>
<td>10.0 (0)</td>
</tr>
<tr>
<td>Erythromycin, 250 mg</td>
<td>6</td>
<td>8.8 (1.5)</td>
</tr>
<tr>
<td>Erythromycin, 500 mg</td>
<td>2</td>
<td>12.0 (2.6)</td>
</tr>
<tr>
<td>Minocycline, 100 mg</td>
<td>1</td>
<td>10.0 (0)</td>
</tr>
<tr>
<td>Tetracycline, 500 mg</td>
<td>5</td>
<td>8.8 (1.6)</td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>9.7 (1.1)</td>
</tr>
</tbody>
</table>
males aged 15 to 19 years, a group at high risk of chlamydial infection, than for those in any other age group. It would be an unfounded assumption that increased testing among the females of lower age in the group 15 to 19 years would detect the same high positivity rate, since a significant proportion of females in this age group are not sexually active. However, rates of infection of 15% to 20% have been reported in studies involving sexually active Canadian adolescent females, and up to 78% of the cases were asymptomatic.\(^{11,16}\) If one assumes a prevalence rate of 10% among the more than 1900 females aged 15 to 19 years in our county, of whom about 50% would be sexually active,\(^{17}\) about 100 cases per year would be expected. We found 17 cases in this age group during the 7-month study period, and of 11 interviewed all were asymptomatic. Younger women in this population may be tested more often when presenting with symptoms and not tested for \textit{C. trachomatis} to the extent that older women are (perhaps as part of routine Papanicolaou testing). Lack of suspicion of the diagnosis in asymptomatic younger women may therefore be contributing to lack of detection of chlamydial infection. Increased efforts may be required by physicians to test when disease is likely to be present, even in the absence of symptoms.\(^8\)

The mean number of sexual partners during the year preceding diagnosis was 2.6 for the males and 2.0 for the females. Only 43% of the females indicated that they had had more than one partner in the 6 months before diagnosis and 18% in the 3 months before. Most of the cases of chlamydial infection diagnosed in this series occurred in those without multiple partners in the months before diagnosis. It is felt that the "core" group of people who are very sexually active and most instrumental in sustaining STDs in communities is often relatively small.\(^8\) Our data indicate that the diagnosis of chlamydial infection must be kept in mind for those who do not change sexual partners very frequently.

The treatment of chlamydial infection was found overall to be in accordance with national guidelines in the 40 cases in which it could be determined. When prescribed, doxycycline and tetracycline were given for periods longer than that recommended. Doxycycline was most often used. The erythromycin dosages were less than those recommended.\(^9\)

Of the patients interviewed four (8.5%) had not been notified of the infection. It should not be presumed that all patients with such infection will call or return for test results. Active treatment should be initiated before the results are known if the diagnosis is likely or if there is doubt about the ability to contact the patient after receipt of the results.

The rates of positive test results were not related to the physicians’ sex, graduation after 1983 (when \textit{Chlamydia} testing became available) or location of practice. The mean number of tests per physician was significantly lower among the rural physicians than among those in the larger communities; however, this in itself cannot be interpreted without knowledge of practice demographics. On the basis of these findings it will be difficult to target specific physician groups for educational efforts.

This study is limited because the individual physician rates of testing and the indications for testing used by the physicians are unknown and because the age of patients was not recorded on all the test requisitions. The study's strength lies in its being a "real-world" observation of physician practice and having a high rate of compliance with requests for interview by patients with positive results. Methods that produced limited patient data were required, because attempts to collect more explicit data from physicians might have led to changes in their approaches to the diagnosis of \textit{C. trachomatis} infection.

Our data may be biased because patient age was available for only 62.9% of the females. If patients of physicians who report age when requesting a test have significantly different age distributions from those of physicians who do not report age, conclusions about patient age may be inaccurate. However, when our data were compared with those from an adjacent county, where age data were available for 76% of females tested for \textit{C. trachomatis} in the same period, we found no significant differences in age distribution (unpublished data, Nova Scotia Department of Health). Similarly, a recent study indicated that more than 30% of women in Nova Scotia tested for \textit{C. trachomatis} are over the age of 29 years, an age group that accounted for only 3% of detected infections.\(^9\)

Our study raises questions about how physicians approach diagnostic testing for \textit{C. trachomatis} infection, particularly with respect to the age groups of patients tested. Further inquiry into the diagnostic approach is necessary. Such a study could involve a systematic review of physician practice, combined with accurate prevalence surveys of \textit{C. trachomatis} infection and estimates of the impact of these practices on resources.

References


---

Conferences continued from page 1263

Nov. 27–28, 1993: Memorial University School of Pharmacy 2nd Annual Symposium — Update on Drug Use: the Rational Use of Antibiotics (in collaboration with the Faculty of Medicine and the Provincial Quality Assurance Committee) St. John’s Dr. Gerald R. Duncan, director and professor of pharmacy, School of Pharmacy, Memorial University of Newfoundland, St. John’s, NF A1B 3V6; tel (709) 737-6571, fax (709) 737-7044

Nov. 28–Dec. 3, 1993: 2nd Dead Sea Conference Tiberias (on the Sea of Galilee), Israel Gil-Kenes, 946–1617 J.F.K. Blvd., Philadelphia, PA 19103, tel (800) 223-3855, fax (215) 568-0696; or Secretariat, 2nd Dead Sea Conference, PO Box 50006, Tel Aviv 61500, Israel, tel 011-972-3-517-4571, fax 011-972-3-660-325


Nov. 30, 1993: 1993 Excellence Conference and 10th Annual Canada Awards for Business Excellence Gala Toronto Conference Board of Canada, 255 Smyth Rd., Ottawa, ON; K1H 8M7; tel (613) 526-3280, fax (613) 526-4857

Dec. 1–4, 1993: Cost Effective Back Care (presented by the American Back Society) San Francisco Study credits available. Dr. Aubrey Swartz, Ste. 401, 2647 E 14th St., Oakland, CA 94601; tel (510) 536-9929, fax (510) 536-1812

Dec. 2–3, 1993: 26th Annual Symposium of the Society of Toxicology of Canada Montreal Gordon Krip, executive director, Society of Toxicology of Canada, PO Box 517, Beaconsfield, PQ H9W 5V1


Dec. 9–11, 1993: EchoVision ‘93 — International Conference on Color Doppler Echocardiography: an Official Conference of International Society for Cardiovascular Ultrasound (organized by the Heart Care Foundation of India) New Delhi, India Dr. K. K. Aggarwal, vice president; or Rakesh Anand, manager, Perfect Health Communications, B 95, Defence Colony, New Delhi–24, India; tel 011-91-11-4631398, fax 011-91-11-6839603

Dec. 9–11, 1993: WorldCon ‘93 — World Congress on Clinical Cardiology (organized by the Heart Care Foundation of India) New Delhi, India Dr. K. K. Aggarwal, vice president; or Rakesh Anand, manager, Perfect Health Communications, B 95, Defence Colony, New Delhi–24, India; tel 011-91-11-4631398, fax 011-91-11-6839603

Dec. 12–19, 1993: Perfect Health Mela ‘93: a Unique Mela Creating Mass Awareness About All Aspects of Health (organized by the Heart Care Foundation of India) New Delhi, India Dr. K. K. Aggarwal, vice president; or Rakesh Anand, manager, Perfect Health Communications, B 95, Defence Colony, New Delhi–24, India; tel 011-91-11-4631398, fax 011-91-11-6839603
Copyright of CMAJ: Canadian Medical Association Journal is the property of Canadian Medical Association and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.